Progress Energy

Crystal River Nuclear Plant
Docket No. 50-302
Operating License No. DPR-72

Ref: 10 CFR 50, Appendix R

September 5, 2003
3F0903-03

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Subject: Crystal River Unit 3 – Manual Operator Actions for Fire Protection

Reference: Crystal River Unit 3 – NRC Inspection Report 50-302/02-05, Triennial Fire Protection Inspection, August 23, 2002 (ML022390719)

Dear Sir:

The purpose of this letter is to provide the NRC with information on the use of post-fire safe shutdown operator actions for Crystal River Unit 3 (CR-3). This information is being provided to initiate regulatory activities for approval of a licensing basis for the use of operator actions for the protection of safe shutdown capability following a fire.

The issue of NRC approval of post-fire manual operator actions for Appendix R III.G.2 fire areas was identified during an internal assessment of the CR-3 Fire Protection Program in June 2002. The issue was documented in the CR-3 corrective action program, and work initiated on a technical study to validate the manual operator actions necessary to respond to a fire and ensure safe shutdown of the plant. Subsequently, NRC Inspection 02-05 initiated an unresolved item (URI 50-302/02-05-01) based on the NRC not having approved the manual operator actions for three CR-3 fire areas.

The CR-3 effort to address this issue involved a validation of the operator action times as well as the limitations imposed by the conditions resulting from a fire. To verify that operator actions would be successful in achieving safe shutdown functions, a timeline for plant system response was developed to define required manual operator action completion times. The system response was ascertained from formal calculations, engineering evaluations, or evaluations of simulator exercises. The validation of manual operator actions included:

- staffing
- emergency lighting
- environmental (temperature, humidity) conditions
- accessibility
- priority of actions
- procedural guidance and training.

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In the process of evaluating individual manual actions the CR-3 approach to preventing spurious actions due to fire damage from affecting the ability to meet the safe shutdown requirements in Appendix R has evolved. The previous approach to dealing with spurious actions was reactive in application, i.e., if a spurious action were to occur during post fire shutdown operations, then instructions were available to respond via manual operator intervention. The new approach is to proactively take Control Room and local actions to protect safe shutdown functions before spurious actions can adversely affect safe shutdown capability per Appendix R, III.G.

CR-3 has substantially completed the technical study portion of the latest Fire Study revision and has validated the operator actions which successfully ensure that safe shutdown functions are performed. The results of the Fire Study as they relate to post-fire operator actions are shown in Attachment A. The attachment is organized according to the function to be preserved or the spurious effect to be prevented. Accomplishing the activities in the Attachment A table may require one or several discrete safe shutdown actions depending on the specific fire area. Attachment B contains the evaluations used to support the validated manual operator actions in Attachment A.

Work is proceeding to accept the results of the revised Fire Study in accordance with the CR-3 design control program. A small number of unresolved items remain which are being tracked within the corrective action program. For the unresolved items, compensatory actions are in effect in accordance with the CR-3 Fire Protection Plan assuring continued protection of safe shutdown capability.

This change in post-fire safe shutdown operation has been reviewed and accepted by the CR-3 Plant Nuclear Safety Committee. Implementation is accomplished through revised Abnormal and Operating Procedures. This strategy for post-fire safe shutdown operations is believed to be far superior to previous procedures.

Progress Energy Florida requests that the NRC review the information contained in this letter and to notify Mr. Sid Powell, Supervisor, Licensing and Regulatory Programs (352 563-4883) as to actions necessary for approval to include the safe shutdown process outlined herein in the licensing basis for Appendix R compliance for CR-3.

No Regulatory Commitments are made in this letter.

Sincerely,

Dale E Young

Dale E. Young
Site Vice President
Crystal River Nuclear Plant

DEY/rmb

Attachments

A. Manual Operator Action Validation
B. Calculations and Analysis Supporting Safe Shutdown Methodology

xc: Regional Administrator, Region II
Senior Resident Inspector
NRR Project Manager

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER - UNIT 3

DOCKET NUMBER 50 - 302 / LICENSE NUMBER DPR - 72

ATTACHMENT A

MANUAL OPERATOR ACTION VALIDATION

The following table presents the validation of manual operator actions in OP-880A, Revision 3, "Manual Operator Action Validation," that are taken proactively when a fire exists in the noted Fire Zone. The table is presented in sections for each of the systems and for each of that system's functions needed to ensure that safe shutdown of the plant can be achieved.

The table is divided into the following columns:

FUNCTIONS – Groups of manual tasks to achieve a performance objective (e.g., Function "EF-2" is to prevent excessive emergency feedwater flow). Achievement of the functions may require one or several discrete operator tasks depending on the fire zone affected.

FIRE ZONE – Those Fire Zones where a fire could cause spurious actuation of equipment.

OP-880A PRESCRIBED ACTION – Summary of manual operator actions required to be performed proactively in a prioritized order.

Operator Action Time – The validated time for an operator to perform the required actions in "s" (seconds) and "m" (minutes). The longest series of tasks for each function were time validated and compared to the analytical requirements. Where the Analytical Time Limit is "> 8 hrs", the manual operator action was not specifically validated in the field due to the extended time available to perform the action.

Analytical Time Limit – The time within which the required actions must be performed in order to achieve safe shutdown of the plant in "min" (minutes) and "hrs" (hours). These times are derived from the referenced Evaluation that is contained in Attachment B to this submittal or a document that is directly referenced.

COMMENT – Any clarifications necessary to the complete understanding of this table.

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
Emergency Feedwater System Alignment					
EF-1	CC-108-107 CC-108-108 CC-124-111	De-energize automatic valves and manually position to ensure proper flow path.	7m 15s	10 min [Eval 13]	Hydraulic limit is to prevent reliance upon HPI/PORV cooling. Only one valve must be de-energized and opened.
EF-2	CC-108-102 CC-108-103 CC-108-104 CC-108-107 CC-108-108 CC-108-109 CC-124-111 CC-124-115 CC-124-116 AB-95-3 IB-95-200B IB-95-200C IB-119-201	Prevent uncontrolled EFW flow: • De-energize and manually position automatic valves OR • Trip EFW pumps	15m 25s	30 min [Eval 15]	Analytical Time Limit is based on two OTSG case. Operator Action Times start at conclusion of EF-1.
EF-3	CC-108-102 CC-108-103 CC-108-104 CC-108-105	Manually transfer suction from EFT-2 /CDT-1 to hotwell	N/A	> 8 hrs [Eval 9]	

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
EF-3 (cont)	CC-108-106 CC-108-107 CC-108-108 CC-108-109 CC-108-110 CC-124-111 CC-124-112 CC-124-113 CC-124-114 CC-124-115 CC-124-116 CC-124-117 CC-145-119 AB-75-4 AB-75-5 AB-95-3 AB-95-3E AB-95-3AA AB-119-6 AB-119-7 AB-119-8 IB-95-200B IB-95-200C IB-119-201 TB-95-401 TB-95-400A TB-95-400E				

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
EF-3 (cont)	TB-119-403 TB-145-400F RB-95-301 RB-119-302				
EF-4	CC-108-103 IB-95-200B IB-95-200C IB-119-201	Determine EFT-2 and CDT-1 level with tank pressure	N/A	> 8 hrs [Eval 9]	
EF-5	CC -108-103 CC-108-104 CC-108-108 CC-108-109 CC-124-111	Remove EFP-1 and -3 from service	N/A	> 8 hrs [EEF-00-005]	This is a long-term contingency action to prevent EFT-2 overheating.

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
Make-Up (High Pressure Injection) System Alignment					
MU-1	CC-124-111	Isolate Letdown flow path locally	27 m	30 min [Eval 5]	EC 50624 will improve access Total Operator Action Time based on priority given to EF-1 and -2.
MU-2	CC-108-102 CC-108-103 CC-108-104 CC-108-105 CC-108-106 CC-108-107 CC-108-108 CC-108-109 CC-108-110 CC-124-111 CC-124-115 CC-124-116 CC-124-117 AB-95-3 AB-119-6	Align Make up flow path by de-energizing valves to prevent spurious operation and manually positioning valves to ensure proper flow path. This includes manually controlling make up flow at HPI valves when system is restarted.	22m 30s	4 hrs [Eval 14]	For AB-95-3, Operator Action Time does not include the 1-hour necessary to suppress a fire in that Fire Zone.
MU-3	CC-108-109 CC-124-111	Starting Make up pumps by manually closing pump beakers	18 m	4 hrs [Eval 14]	Total Operator Action Time would include MU-1, -2, and -3 as well as EF-1 and -2 based on staff

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
MU-3 (cont)					assignment and priority. The total is ~70 minutes which remains well within the 4 hr limit.
Main Steam System Alignment					
MS-1	CC-108-102 CC-108-103 CC-108-104 CC-108-105 CC-106-108 CC-108-107 CC-108-108 CC-108-109 CC-108-110 CC-124-111 CC-124-112 CC-124-113 CC-124-114 CC-124-115 CC-124-116 CC-124-117 CC-145-119 AB-75-4 AB-75-5 AB-95-3	Manually control ADVs to control RCS cooldown	N/A	> 8 hrs [Eval 16]	

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
MS-1 (cont)	AB-95-3E AB-95-3AA AB-119-6 AB-119-7 AB-119-8 IB-95-200B IB-95-200C IB-119-201 TB-95-401 TB-95-400A TB-95-400E TB-119-403 TB145-400F RB-95-301 RB-119-302				

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
Feedwater System Alignment					
FW-1	CC-108-102 CC-108-103 CC-108-104 CC-108-105 CC-108-106 CC-108-107 CC-108-108 CC-108-109 CC-108-110 CC-124-111 CC-124-115 CC-124-116 CC-124-117 AB-95-3 AB-119-6 IB-95-200B IB-95-200C 1B-119-201	Turn off FW booster pumps if any FW block valves fail to close	N/A	> 8 hrs [Eval 27]	

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
Ventilation System Alignment					
V1	CC-108-106 CC-108-108 CC-108-109 CC-108-110 CC-108-111 CC-124-114 CC-124-117 CC-145-119 AB-199-6	Line up and start Appendix R cooling	6 m	60 min [Eval 16]	Operator Action Time is from CC-108-109.
V2	CC-108-109	Operate CC Chiller at Switchgear	1 m	2 hrs [Eval 16]	
V-3	CC-108-102 CC-108-103 CC-108-104 CC-108-105 CC-108-106 CC-108-107 CC-108-108 CC-108-109 CC-108-110 CC-124-111 CC-124-112	Open doors between TB 119 and IB 119 to provide natural circulation to provide access to ADVs	N/A	> 8 hrs [Eval 16]	

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
V-3 (cont)	CC-124-113 CC-124-114 CC-124-115 CC-124-116 CC-124-117 CC-145-119 AB-75-4 AB-75-5 AB-95-3 AB-95-3E AB-95-3AA AB-119-6 AB-119-7 AB-119-8 IB-95-200B IB-95-200C IB-95-201 TB-95-401 TB-95-400A TB-95-400E TB-119-403 TB-145-400F RB-95-301 RB-119-302				
V-4a	CC-108-105	Ventilate A battery charger room	N/A	> 8 hrs [Eval 16]	

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
V-4b	CC-108-107	Ventilate the following areas: o Corridor El 108 and Battery Charger Room B o Battery Charger Room A and Battery Charger Room B o Battery Charger Room A and Inverter Room B o Inverter Room A and Inverter Room B o 4160 V Switchgear Room A and Inverter Room B o Stairwell and Corridor El 108" o Stairwell and Corridor El 124'	N/A	> 8 hrs [Eval 16]	

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
Electrical System Alignment					
EL-1	CC-108-107 CC-108-108 CC-108-109 CC-124-111 CC-145-119	Prevent spurious tripping of ES 4160v bus lockouts	2m 30s	30 min [Eval 16]	Operator Action Time based on operator coming from MUV-49.
EL-2a	CC-108-102	Cross-tie ES 480V busses to support restoration of ventilation (AHF-54A)	TBD	30 min [Eval 16]	Analytical Time Limit is based on alignment to CHHE-1B. EC/ED 54293 Operator Action Time will be based on guidance being developed for stripping loads on the 480V busses.
EL-2b	CC-124-111	Cross-tie ES 480V busses to support restoration of DC power (VBIT-A, -C)	TBD	4 hrs [SBO calc]	Operator Action Time will based on guidance being developed for stripping loads on the 480V busses.
EL-3	AB-95-3 CC-108-103 CC-108-109	Align power to CHHE-2 and CHP-2	TBD	60 min [Eval 16]	CHHE-2 limiting Operator Action Time will be based on guidance being developed for stripping loads on the 480V busses.

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
Component Closed Cooling System Alignment					
CCC-1	CC-108-106 CC-108-109 CC-124-111	Starting RWPs, SWPs, and DCPs by manually closing pump beakers	5 m	2 hrs [Eval 11]	RW/SW limiting. Longer time available for other systems. Operator Action Time is for travel time and manual start of a single pump.
CCC-2a	CC-108-103 CC-108-109	Manually align SW cooling to RB	N/A	> 8 hrs [Eval 16]	NCR 103111
CCC-2b	CC-108-102 CC-108-105 CC-108-106 CC-108-109 AB-95-3 AB-119-6	Manually Isolate CI cooling to RB	N/A	N/A	EC/ED 53098
CCC-2c	CC-108-102 CC-108-104 CC-108-106 IB-119-201 RB-95-301 RB-119-302	Manually Align cooling to AHF-1C	N/A	> 8 hrs [Eval 16]	NCR 103111

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
Decay Heat (Low Pressure Injection) System Alignment					
DH-1a	CC-108-108 CC-124-117 AB-95-3 AB-119-6	Preserve BWST contents. Isolate and de-energize valves in flow path from BWST to RB sump.	NA	N/A	AP-880 will promptly isolate DHV-34/-35. Removing power and manual positioning will be retained in OP-880A as a contingency action. NCRs 102599 and -102600
DH-1b	CC-108-108 CC-124-117 AB-95-3 AB-119-6	Transfer contents of RB Sump to BWST	N/A	N/A	NCRs 102599 and -102600
DH-2	AB-95-3 CC-108-106 CC-124-111	Manually start DH pump	N/A	> 8 hrs [Eval 10]	
DH-3	CC-108-102 CC-108-103 CC-108-104 CC-108-105 CC-108-106 CC-108-107 CC-108-108 CC-108-109	Manually align valves to establish DHR	N/A	> 8 hrs [Eval 10]	

FUNCTION	FIRE ZONE	OP-880A PRESCRIBED ACTION	Operator Action Time	Analytical Time Limit	COMMENT
DH-3 (cont)	CC-108-110 CC-124-111 CC-124-112 CC-124-113 CC-124-114 CC-124-115 CC-124-116 CC-124-117 AB-75-4 AB-75-5 AB-95-3 AB-95-3E AB-95-3EE AB-119-6 IB-95-200B IB-95-200C IB-195-201 TB-95-401 TB-95-400A TB-95-400E TB-119-403 TB-145-400F RB-95-301 RB-119-302				

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CRYSTAL RIVER UNIT 3

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ATTACHMENT B

CALCULATIONS AND ANALYSIS SUPPORTING SAFE SHUTDOWN METHODOLOGY

The following table contains the evaluations noted in Attachment A. Note that only the evaluations from the draft Fire Study that support the manual operator functions in Attachment A are included.

The table is presented in columns as follows:

Evaluation No. – The evaluation identification number used in the draft Fire Study and noted in Attachment A.

Recovery Time / System Adequacy Description – A description of the success and timing of the given operator action.

References – The source documents used to determine the success and timing of the given operator functions.

	Evaluation No.	Recovery Time/System Adequacy Description	References
5	MUP Suction Flow Alignment (Action Time to isolate letdown – 30 minutes to isolate MUV-49)	In the event of an Appendix R fire scenario, the MUT is isolated in order to prevent gas binding of the operating MUP. Calculation M94-0053, "Allowable MUT-1 Indicated Overpressure vs. Indicated Level, Section V.12 "Appendix R Concerns," addresses two cases involving failure of MUV-143 (Hydrogen supply solenoid valve). Case 16 assumed letdown was in service through the event. In this case, it was found that MUV-58 is required to be opened, the MUT and letdown isolated within approximately 73 minutes to prevent gas from being entrained in the operating MUP. Case 16 assumes the Reactor is at full power and cooldown has not started (with 8 hour hold time). The second is Case 15 where letdown was not in service, MUV-143 failed open and the MUT required isolation within 19 minutes to prevent gas entrainment of the operating MUP. CR-3 no longer operates with hydrogen lined up to the MUT. Hydrogen (and nitrogen) are manually isolated to prevent uncontrolled pressurization of the MUT when the	Calculation M94-0053, Revision 7 Calculation F97-0017, Revision 0 Calculation M96-0011, Revision 0 Calculation M95-0009, Revision 0 Calculation M97-0042, Revision 0 OP-402, Revision 125, Makeup and Purification System Calculation M03-0006, Revision 0

Evaluation No.	Recovery Time/System Adequacy Description	References
5 (cont)	corresponding solenoid valves fail open during a postulated Appendix R fire. Only manual gas additions are made using a dedicated operator. Maximum fill pressures based upon tank level to prevent gas entrainment of the MUP header are provided in OP-402. Letdown should still be isolated to insure maintenance of pressurizer level. Based upon a normal operating level of 220" and a normal letdown rate of 45 gpm, operator action in the first 30 minutes would yield a letdown loss of 1350 gallons. At 12.2 gal/in in the pressurizer, this yields a net change of -110" or a new level of 110", sufficient to remain on scale.	

	Evaluation No.	Recovery Time/System Adequacy Description	References
7	BWST Drain down (Action Time – Per NCR 102600)	In the event of an Appendix R fire scenario, charging from the BWST via at least one high-pressure injection flowpath will provide borated water. Due to spurious valve (DHV-42/43) operation, the potential exists to drain the BWST into the containment sump. This could result in a loss of BWST water to support RCS inventory control and boration. This potential has been addressed as part of the change of the normal position of DHV-34 and 35. This ensures the ability to refill the BWST in the event of inadvertent draindown. Additionally, an analysis was performed (EEE-99-004) to determine that it is acceptable to run a DH pump without cooling for a sufficient duration (<1/2 hour) to restore BWST volume.	Engineering Evaluation EEE-99-004, Revision 0 NCR 102600

	Evaluation No.	Recovery Time/System Adequacy Description	References
9	Condensate Inventory (Action Time – 17 hours to align EFP-1/2 to alternate suction supply)	From calculation F97-0010: • The depletion time of EFT-2, with the minimum volume of 150,000 gallons, is approximately 17 hours. • The EFW requirement to meet natural circulation cooldown to 280°F is 862,000 gallons. Calculation F97-0010 also addresses hold times related to available condensate inventory and cooldown rates. Safety Assessment for AP-990, Revision 09 also addresses condensate inventory.	Calculation F97-0010, Revision 3
10	Cooldown using one DH Pump and Heat Exchanger. (Action Time > 8 hours to initiate DH cooling)	Ensure that a single DH pump and heat exchanger can support achieving and maintaining cold shutdown. Calculation F97-0017 titled, "Appendix R Cooldown," identifies that a single train of Decay Heat (DH) can complete a cooldown to cold shutdown within 69 hours. (Satisfying the 72 hour Appendix R requirement). DH is initiated at 64 hours (280°F RCS) and runs a total of 5 hours to bring RCS from 280°F to 200°F. Therefore, the DH pumps, DH pump cooling (DC) and DH heat exchangers are required to be operable prior to 64 hours.	Calculation F97-0017, Revision 0 EDBD Tab 6/3, Revision 15

	Evaluation No.	Recovery Time/System Adequacy Description	References
11	Alignment of Equipment Cooling Systems: • Decay Heat Closed Cycle Cooling (DC) System (Action Time – 64 hours to assure DC is operable) • Nuclear Services Closed Cycle Cooling (SW) System (Action Time - 4 hours maximum or prior to starting the MU pumps) (Action Time – 2 hours maximum or prior to starting the Chillers) • Nuclear Service and Decay Heat Sea Water (RW) System (Action Time – 64 hours to assure RWP-3A or RWP-3B is operable) (Action Time - 2 hours maximum to start RWP-2A/B or	Ensure that safe shutdown can be achieved using the minimum available cooling water pumps and determine the need to isolate non-essential loads on the NS CCC System to support necessary cooling and/or prevent pump runout. The time to establish cooling is based on the equipment that the system cools. Cooling shall be established prior to start of essential equipment. Decay Heat System (DH) Calculation F97-0017 identifies that cooldown from 280°F (DH is placed in service) to 200°F is not required until 64 hours, which is the end of ADV cooldown. Therefore, any repairs or manual actions needed to align the system are required to be completed within 64 hours. For the DH system, the Decay Heat Closed Cycle Cooling System (DC) system provides cooling and the Nuclear Services and Decay Heat Sea Water System (RWP-3A/B) provides cooling to the DC system. Therefore, the DC and RW systems must be operable within 64 hours. Make-up System (MU) Evaluation 14 identifies that the Make-up system is not required to be started until 4 hours following a spurious actuation that would cause the loss of HPI. The Nuclear Service Close Cycle Cooling System (SW) provides cooling to the	Calculation F97-0017, Revision 0 EDBD Tab 6/3, Revision 15 (DH System) EDBD Tab 6/6, Revision 9 (DC System) EDBD Tab 6/12, Revision 8 (RW System) ED Tab 6/2, Revision 17 (MU System)

	Evaluation No.	Recovery Time/System Adequacy Description	References
11 (cont)	prior to start of Chillers) (Action Time – 4 hours maximum to start RWP-2A/B or prior to start of MU pumps)	MU pump motors and lube oil coolers and the Nuclear Services and Decay Heat Sea Water System (RW provides cooling to the SW system (RWP-2A/B). Therefore, SW and RW cooling systems are to be established prior to starting the MU pumps. Control Complex Cooling (CH) Evaluation 16 identifies that the Control Complex Chillers (CHHE-1A/B) are to be operating within 2 hours following a trip due to a fire. The Nuclear Service Close Cycle Cooling System (SW) provides cooling to the CC chillers and Decay Heat Sea Water System (RW) provides cooling to the SW system (RWP-2A/B). Therefore, SW and RW cooling system are to be established prior to starting the Chillers.	

	Evaluation No.	Recovery Time/System Adequacy Description	References
13	Time to Restore Emergency Feedwater (Action Time – 10 minutes to preclude reliance upon HPI-PORV cooling)	Following a postulated fire, Emergency Feedwater flow may need to be manually established using the Emergency Feedwater pumps or Auxiliary Feedwater pump. EFIC Circuitry is independent of the control room/cable spreading rooms, therefore for alternate shutdown scenarios EFIC establishes the Emergency Feedwater Flow automatically. For all other fire areas, losses can be 1) mitigated from the Control Room, or 2) result in the loss of flow to only one Steam Generator. Time constraints to provide positive control include: • 10 minutes to establish EFW to preclude HPI /PORV cooling • < 5 hours to establish some flow to dry OTSG to prevent exceeding tube-to-shell delta T	Drawing 205, 208 series drawings associated with EFIC/EFW B&W Analysis 86-1173989-01 EM-225D OE16404

	Evaluation No.	Recovery Time/System Adequacy Description	References
14	Time to restore Makeup and minimum flow recirculation lines (Action Time – 4 hours to regain control of make-up)	Following a postulated fire, make-up must be established before unrecoverable conditions are reached, and ideally, while pressurizer level remains in the indicating range. M97-0064 looks at pressurizer level versus Tave. Per this calculation, a drop in Tave of 30°F results in a pressurizer level decrease from 220" to 56". Per F92-0002, Attachment 3, Tave drops 12°F over a 4-hour period. Based on this information, there is sufficient volume in the pressurizer to make up for shrinkage of the RCS and for any minor system leakage over a 4-hour period if make-up is unavailable. Therefore, it is expected that pressurizer level will remain in the indicating range. Therefore, there are approximately 4 hours to regain control of make-up, if the plant maintains a hot standby condition until make-up control can be regained. Minimum flow recirculation lines shall be established prior to start of Make-up pumps.	Calculation F92-0002, Revision 1 Calculation E90-0088, Revision 1 Calculation M97-0064, Revision 3

	Evaluation No.	Recovery Time/System Adequacy Description	References
15	Time to Isolate Emergency Feedwater (EFW) (Action Time – 30 minutes with 2 OTSGs) (Action Time – 17 minutes with 1 OTSG)	Uncontrolled EFW flow into a Steam Generator could result in an overfill condition into the Main Steam lines. Calculation MSC-0482-5500-035-001 was performed and presented in letter FCS-6721, dated 7/18/85. Gilbert/Commonwealth analyzed the potential effects of uncontrolled Emergency Feedwater flow to the OTSGs. It was concluded that if both OTSGs are being fed then it would take approximately 30 minutes to fill and, if only one OTSG is being fed, it would take approximately 17 minutes.	Calculation MSC-0482-5500-035-001
16	Impact of Loss of HVAC Systems (Action Time – 30 minutes to start normal CC return and supply fans, 2 hours to start chillers CHHE-1A/B) (Action Time – 60 minutes to start App R Chiller and AHF-54B) (Action Time – See write-up for times to open doors)	The following ventilation systems are credited: ▪ Normal Control Complex HVAC (CHHE-1A/B) ▪ Appendix R Chiller (CHHE-2) ▪ EFIC Room HVAC (AHF-54B) ▪ IB Ventilation	Calculation H97-0004 Calculation M97-0052 Calculation F97-0010 Calculation H97-0001, Revision 7 Calculation E89-0088, Revision 1

	Evaluation No.	Recovery Time/System Adequacy Description	References
16 (cont)	(Action Time – 4 hours for RB fans) Ref NCR 103111	▪ RB Fans	
	(Action Time – N/A for DG Room Fans)	▪ DG room fans Control Complex and EFIC Room HVAC - Fire in Battery Charger Room B *(in conjunction with Case 1 of H97-0004 and H97-0001)* **With normal control complex cooling (CHHE-1A/B) available:** o Start one supply fans (AHF-17A/B), one return fan (AHF-19A/B) and one EFIC Room Cooler (AHF-54A/B) in 30 minutes. o Start one Chiller (CHHE-1A/B) and one Chilled Water Pump (CHP-1A/B) in 120 minutes. - Open door between Battery Charger Room A and Inverter Room A within 12 hours of verifying a fire in Battery Charger Room B. ▪ Loss of Ventilation to all Fire Areas in the Control Complex *(in accordance with Case 2 of H97-0004)* The Appendix R Chiller (CHHE-2) and Air Handling Unit (AHF-54B) must be in service	

Evaluation No.	Recovery Time/System Adequacy Description	References
16 (cont)	within 60 minutes from confirming a fire and loss of normal ventilation. ▪ Fire in 4160 V Switchgear Room B *(in conjunction with Case 3 of H97-0004 and H97-0001)* **With normal control complex cooling available:** o Start one supply fans (AHF-17A/B), one return fan (AHF-19A/B) and one EFIC Room Cooler (AHF-54A/B) in 30 minutes. o Start one Chiller (CHHE-1A/B) and one Chilled Water Pump (CHP-1A/B) in 120 minutes. - Within 10 hours, open the following doors: o Corridor El 108 and Battery Charger Room B o Battery Charger Room A and Battery Charger Room B o Battery Charger Room A and Inverter Room B o Inverter Room A and Inverter Room B o 4160 V Switchgear Room A and Inverter Room B o Stairwell and Corridor El 108 o Stairwell and Corridor El 124	

Evaluation No.	Recovery Time/System Adequacy Description	References
16 (cont)	Intermediate Building HVAC - Calculation M97-0052 ▪ Open door H-201 and H-202 between the TB and IB within 8 hours. Opening the doors at T = 9 hours will result in a plant cooldown delay of 1 hour (time for room to cool to 138°F for personnel access to open ADVs for plant cooldown). From F97-0010, the time to cold shutdown, with an 8-hour delay, is 68 hours. An additional delay of 1 hour will extend this to 69 hours, which is still within the 72-hour requirement. Diesel Generator Rooms: No time to restore was calculated because fans for credited DG are available or Off-site power is credited. RB Fans: Engineering judgment was previously used to demonstrate that RB temperature was acceptable for a 9-hour period. A formal analysis will be generated to validate/ document this judgment. SBO analysis E89-0088 evaluates RB temperature effects for a 4 hour period. Engineering judgment was previously used to demonstrate that RB temperature was acceptable for a 9-hour period. A formal analysis will be generated to validate/ document this judgment. See NCR 103111.	

	Evaluation No.	Recovery Time/System Adequacy Description	References
27	FW Booster Pump (FWBP) Operation following Main FW Pump trip (Action Time > 8 hours to discontinue FW Booster Pump operation)	The Feedwater Booster Pumps are rated for 12,760 gpm at 710' TDH at 305°F. Normal full power suction pressure for the booster pumps is about 60 psig and normal discharge pressure is about 300-350 psig (actual pressures are load dependant). Whether at full power or post-trip, the OTSGs are at over 900 psig and1000 psig. The FWBPs will not be able to feed the OTSGs at > 350 psig. As flow from the FWBPs decreases to < 3000gpm, the recirculation valves to the deaerator (FWT-1) open and the pumps operate in recirculation mode to FWT-1. The FWBP recirculation valves FWV-47 and -48 are air-operated valves located on the 145' level of the Turbine Building, beside FWT-1. The valves fail open on a loss of instrument air or a loss of power to the associated valve actuator solenoid valve. The FWBP pumps will trip if FWT-1 level drops below 2 feet-10 inches. Main Feedwater Line Isolation (MFLI) closes FWV-14 and FWV-15 which prevent the FWBPs from overfilling the steam generators when OTSG pressure is below 350 psig. No action times are required for FWBPs.	OPS-4-68 FW Drawing 302-081 FW Byron Jackson Manual (FW Booster Pumps) AP-990, Revision 9